XC2406A816UR-G

TOREX

ETR2704-002a

1.6GHz ON/OFF Function LNA

■GENERAL DESCRIPTION

The XC2406A816UR-G is an ultra-low-noise amplifier (LNA) with low operating voltage, low noise figure (NF), low power consumption using CMOS process, The XC2406 is designed for GPS band frequency (1.6GHz).

The IC's internal circuit can be placed in stand-by mode via the CE function, In the stand-by mode, consumption current is greatly reduced and there is no need to add external ON/OFF control function like LDO.

External R_{BIAS} can adjust power supply to any voltage of 1.71V~3.63V as self bias function. Standard power supply voltages are .3.45V, 3.00V, 2.85V and 1.80V.

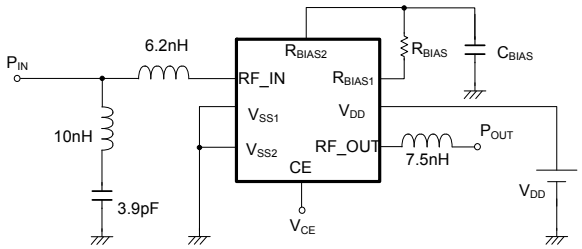
■APPLICATIONS

●GPS band RF signal amplified

■FEATURES

Noise Figure	: NF=0.96dB(TYP.) (@ 1.575GHz)
Low Power Consumption	: 11.88mW (TYP.) (V_{DD}=1.80V, R_{BIAS}=92Ω)
High Gain	: S21=18dB(TYP.) (@ 1.575GHz)
CE Function	: CE “H” Voltage 1.1V～V_{DD} (1.71V≦V_{DD}≦3.15V) CE “L” Voltage 0V～0.4V
Operation Voltage Range	: 1.71V～3.63V
Output	: CMOS Output, 50Ω Driver Built-in
Operating Temperature Range	: - 40℃～+ 85℃
Package	: USP-8A01
Environmentally Friendly	: EU RoHS Compliant, Pb Free

■TYPICAL APPLICATION CIRCUIT



TOP VIEW

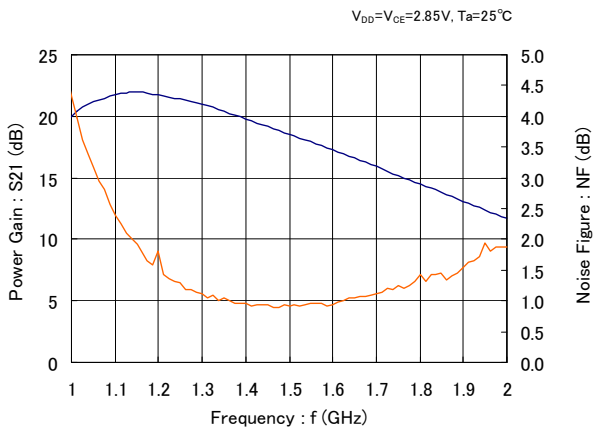
V_{DD} [V] (TYP.)	R_{BIAS} [Ω]
3.45	390
3.00	300
2.85	270
1.80	92

* R_{BIAS} should be used in ±1% tolerance and ±200ppm/℃ temperature stability.

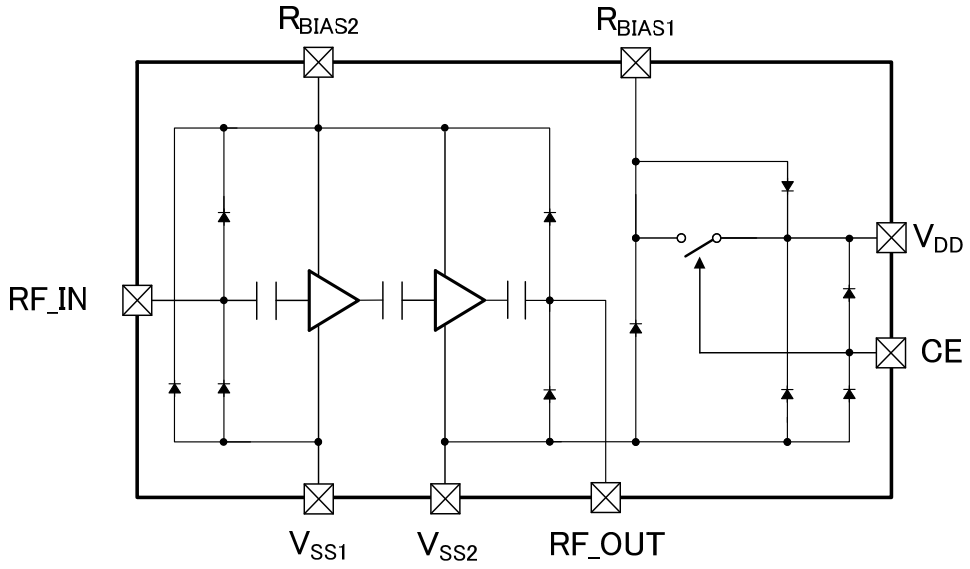
■TYPICAL PERFORMANCE CHARACTERISTICS

Power Gain / Noise Figure vs. Frequency

XC2406A816



■BLOCK DIAGRAM



* Diodes inside the circuit are an ESD protection diode.

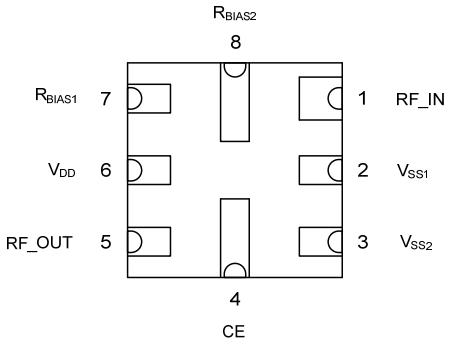
■PRODUCT CLASSIFICATION

●Ordering Information

PRODUCT NAME	PACKAGE	ORDER UNIT
XC2406A816UR-G (*1)	USP-8A01	3,000 / Reel

(*1) The “-G” suffix denotes Halogen and Antimony free as well as being fully RoHS compliant.

■PIN CONFIGURATION



USP-8A01
(BOTTOM VIEW)

■PIN ASSIGNMENT

PIN NUMBER	PIN NAME	FUNCTION
1	RF_IN	RF Signal Input
2	V_{SS1}	Ground
3	V_{SS2}	Ground
4	CE	ON/OFF Control Pin
5	RF_OUT	RF Signal Output
6	V_{DD}	Power Supply
7	R_{BIAS1}	R_{BIAS} Connect Pin
8	R_{BIAS2}	R_{BIAS} Connect Pin

■FUNCTION CHART

PIN NAME	SIGNAL	STATUS
CE	CE Low	Stand-by
	CE High	Active
	CE OPEN	Undefined State

■ABSOLUTE MAXIMUM RATINGS

Ta=25℃

PARAMETER	SYMBOL	RATINGS	UNITS
Power Supply Voltage	V_{DD}	-0.3～4.0	V
CE Input Voltage	V_{CE}	-0.3～V_{DD}+0.3 or 4.0 (*1)	V
Current Circuit	I_{DD}	42	mA
R_{BIAS1} Input Voltage	R_{BIAS1}	-0.3～V_{DD}+0.3 or 4.0 (*1)	V
R_{BIAS2} Input Voltage	R_{BIAS2}	-0.3～+1.6	V
RF Input Power	P_{IN}	10	dBm
RF_IN Input Voltege	V_{RF_IN}	-0.3～R_{BIAS2}+0.3 or +1.6 (*2)	V
RF_OUT Input Voltege	V_{RF_OUT}	-0.3～R_{BIAS2}+0.3 or +1.6 (*2)	V
Power Dissipation	Pd	120	mW
Operating Ambient Temperature	Topr	-40～+85	℃
Storage Temperature	Tstg	-55～+125	℃

* All voltages are described based on the V_{SS1} and V_{SS2} pin.

V_{SS1} pin and V_{SS2} pin should be connected each other outside.

(*1) The maximum value should be either V_{DD}+0.3V or +4.0V in the lowest.

(*2) The maximum value should be either R_{BIAS2}+0.3V or +1.6V in the lowest.

■ELECTRICAL CHARACTERISTICS

●DC Characteristics Ta=25℃

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS	CIRCUIT
Power Supply Voltage	V_{DD}	R_{BIAS}=390Ω (*2)	3.278	3.450	3.630	V	①
		R_{BIAS}=300Ω (*2)	2.850	3.000	3.150	V	①
		R_{BIAS}=270Ω (*2)	2.708	2.850	2.992	V	①
		R_{BIAS}=92Ω (*2)	1.710	1.800	1.890	V	①
Current Circuit	I_{DD}	1.71V≦V_{DD}≦3.63V (*1) V_{CE}=V_{DD}	-	6.6	8.9	mA	①
Stand-by Current	I_{STBY}	1.71V≦V_{DD}≦3.63V (*1) V_{CE}=0V	-	-	0.1	μA	①
CE "H" Level Voltage	V_{CEH}	1.71V≦V_{DD}≦3.15V	1.1	-	V_{DD}	V	①
		3.15V<V_{DD}≦3.63V	1.3	-	V_{DD}	V	①
CE "L" Level Voltage	V_{CEL}	-	0	-	0.4	V	①

(*1) For the relation of V_{DD} and R_{BIAS}, Please refer to the “Power Supply Voltage vs. R_{BIAS} Table” below.
(*2) R_{BIAS} should be used in ±1% tolerance and ±200ppm/℃ temperature stability.

●AC Characteristics V_{DD}=V_{CE}=2.85V, R_{BIAS}=270Ω, Ta=25℃

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNITS	CIRCUIT
Power Gain	S21	f=1.575 GHz	15.0	18.0	-	dB	②
Input Return Loss	S11	f=1.575GHz	-	7.5	-	dB	②
Output Return Loss	S22	f=1.575GHz	-	13	-	dB	②
Isolation	S12	f=1.575GHz	-	-33	-	dB	②
Noise Figure (*1)	NF	f=1.575GHz	-	0.96	-	dB	③
Input Power IP3	I_{IP3}	f=1.575GHz, 1.576GHz	-	-20	-	dBm	④
Input Power IP2	I_{IP2}	f=0.8GHz, 2.375GHz	-	12.2	-	dBm	④
Input Power @ 1dB Gain Conpression	P1dB	f=1.575GHz	-	-28.0	-	dBm	②

(*1) NF is the value excluding the substrate loss.

Power Supply Voltage vs. R_{BIAS}

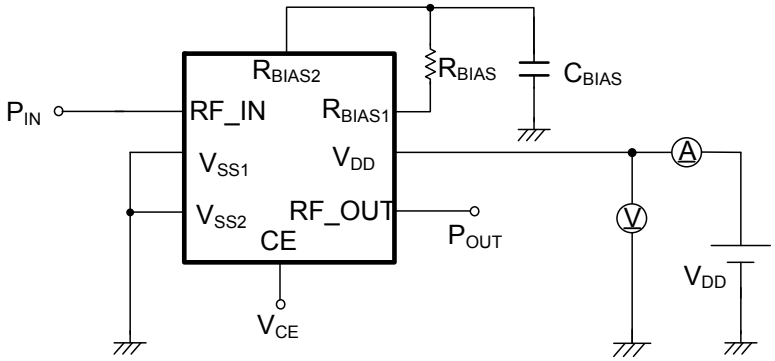
V_{DD} [V]	R_{BIAS} [Ω]
3.278～3.630	390
2.850～3.150	300
2.708～2.992	270
1.710～1.890	92

■NOTE ON USE

1. For temporary, transitional voltage drop or voltage rising phenomenon, the IC is liable to malfunction should the ratings be exceeded.
2. Please eliminate static electricity from the operational table, people, and soldering iron.
3. Please use noiseless power supply for stable operation.
4. Please connect C_{BIAS} to R_{BIAS2} pin as close as possible.
5. V_{SS1} pin and V_{SS2} pin should be connected each other outside.
6. Please ensure to use an external component which does not depend on bias or temperature too much.
7. Torex places an importance on improving our products and their reliability.
   We request that users incorporate fail-safe designs and post-aging protection treatment when using Torex products in their systems.

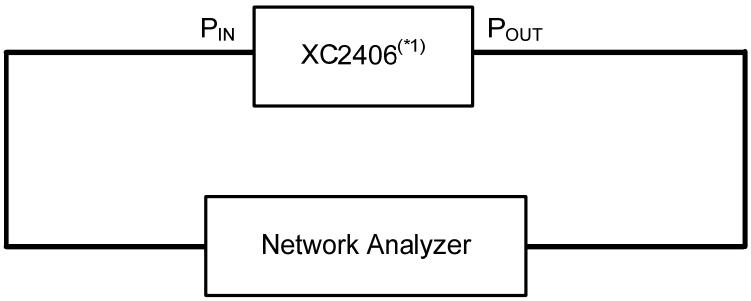
■TEST CIRCUITS

●Circuit ① (DC Characteristics: Power Supply Pin Voltage, Circuit Current, Stand-by current)



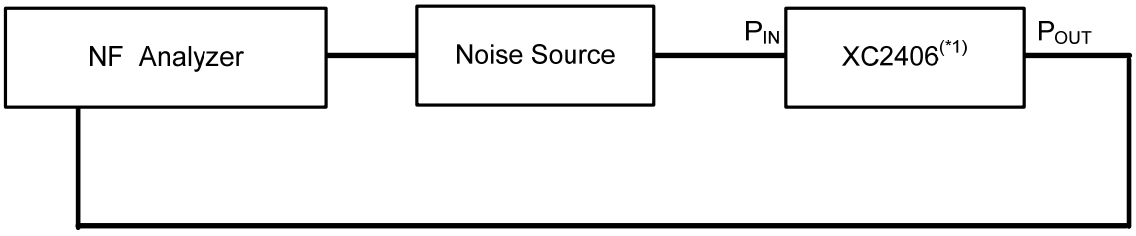
* P_{IN} / P_{OUT} is 50Ω

●Circuit ② (Power Gain, Input Return Loss, Output Return Loss, Isolation, Input Power @ 1dB Gain Compression)



(*1) Refer to the circuit ⑤ for the block detail.

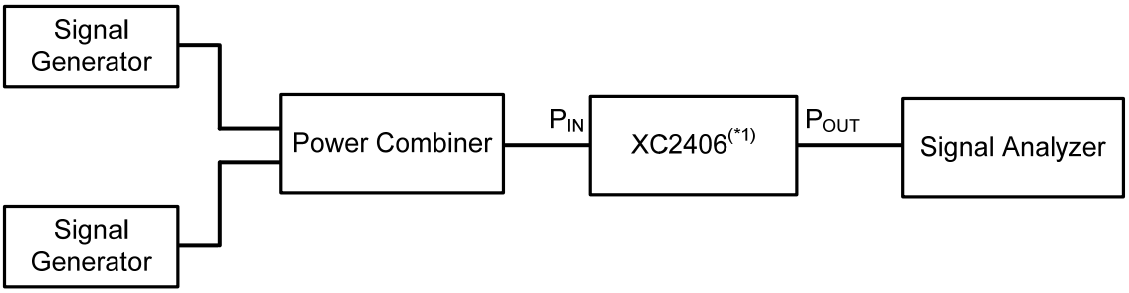
●Circuit ③ (Noise Figure)



(*1) Refer to the circuit ⑤ for the block detail.

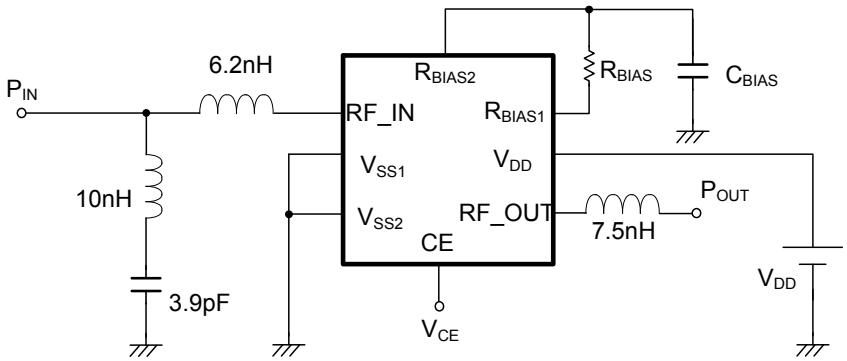
■TEST CIRCUITS (Continued)

●Circuit ④ (Input Power IP3, Input Power IP2)



(*1) Refer to the circuit ⑤ for the block detail.

●Circuit ⑤ (XC2406 series, the circuit of the block)

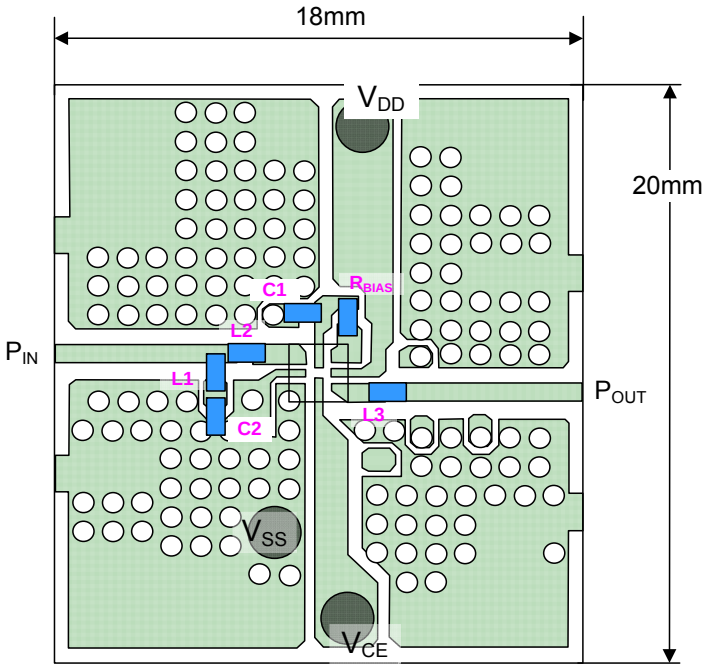


V_{DD} [V] (TYP.)	R_{BIAS} [Ω]
3.45	420
3.00	390
2.85	360
1.80	120

* R_{BIAS} should be used in ±1% tolerance and ±200ppm/℃ temperature stability.

■TEST CIRCUITS (Continued)

Evaluation Board



PCB (FR-4)
MICROSTRIPLINE WIDTH=0.6mm
t=0.18mm
PCB size=18mm × 20mm

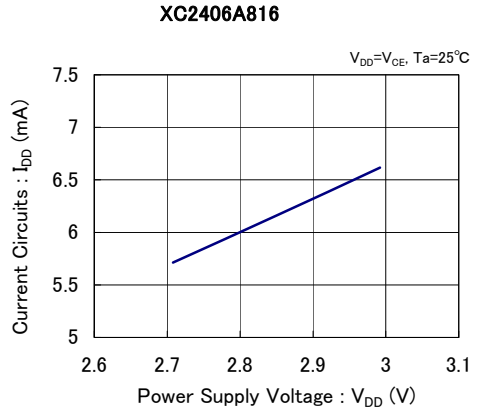
* Please use an external component which does not depend on bias or temperature too much.

External Components

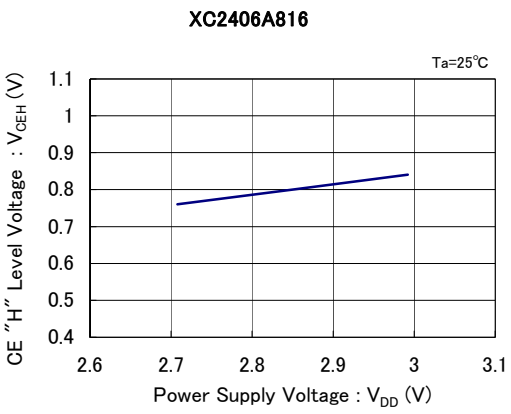
SYMBOL	SPEC	COMMENT
C1	10nF	-
C2	3.9pF	-
L1	6.2nH	MURATA (LQW15A6N2G00D)
L2	10nH	MURATA (LQW15A10NG00D)
L3	7.5nH	MURATA (LQW15A7N5G00D)
R_{BIAS}	-	Less than ±1% tolerance, Less than ±200ppm / ℃ temperature stability

■TYPICAL PERFORMANCE CHARACTERISTICS

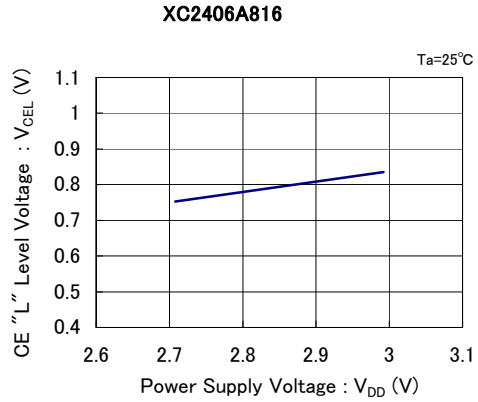
(1) Current Circuits vs. Supply Voltage



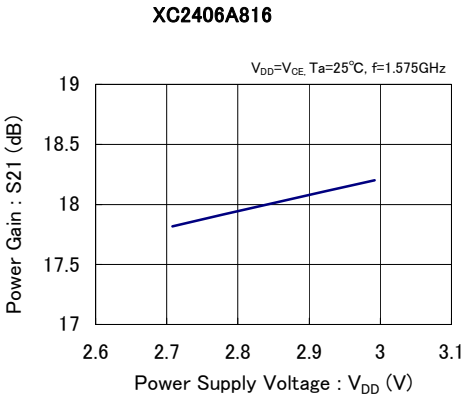
(2) CE “H” Level Voltage vs. Supply Voltage



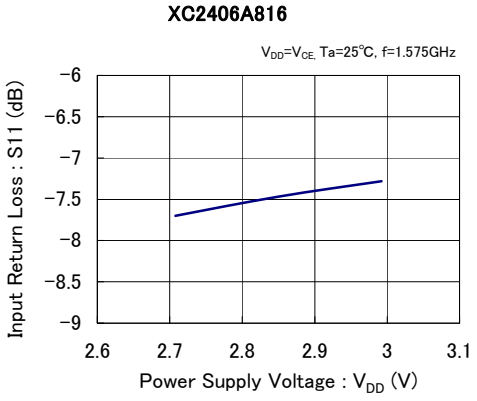
(3) CE “L” Level Voltage vs. Power Supply Voltage



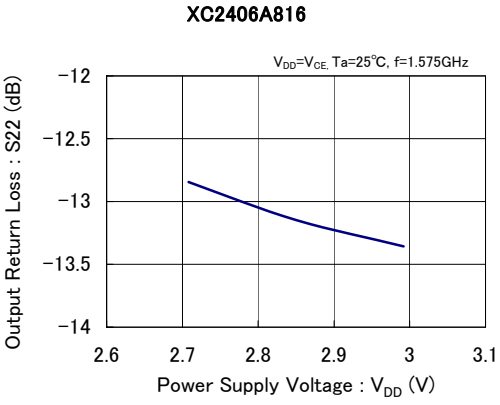
(4) Power Gain vs. Power Supply Voltage



(5) Input Return Loss vs. Power Supply Voltage

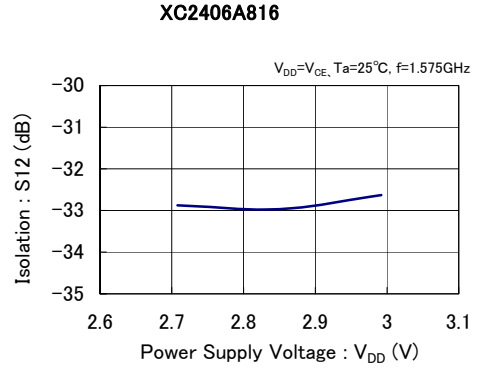


(6) Output Return Loss vs. Supply Voltage

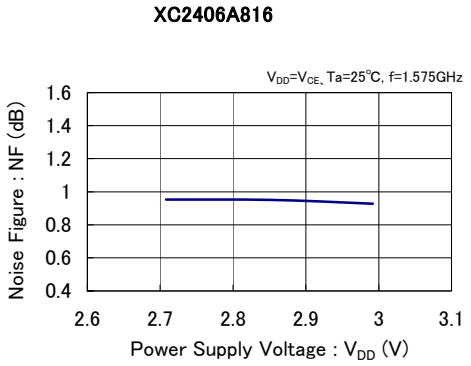


■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

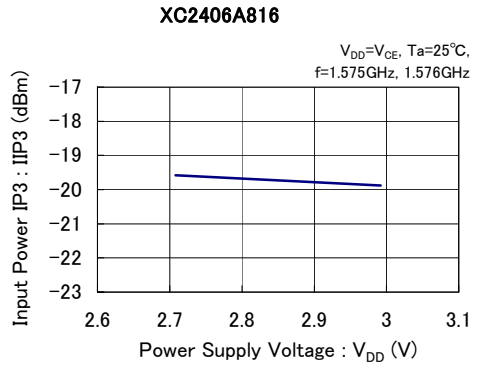
(7) Isolation vs. Power Supply Voltage



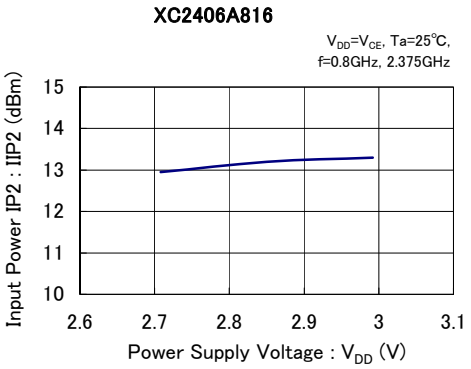
(8) Noise Figure vs. Power Supply Voltage



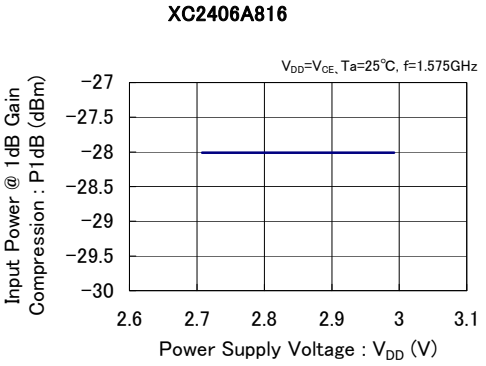
(9) Input Power IP3 vs. Power Supply Voltage



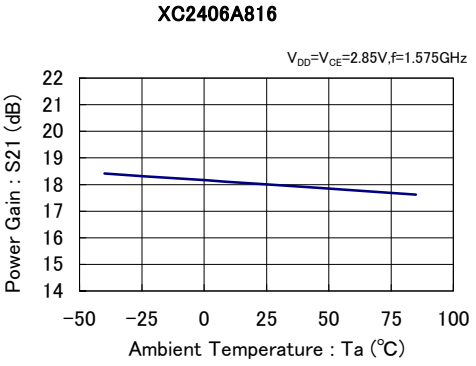
(10) Input Power IP2 vs. Power Supply Voltage



(11) Input Power @ 1dB Gain Compression vs. Power Supply Voltage

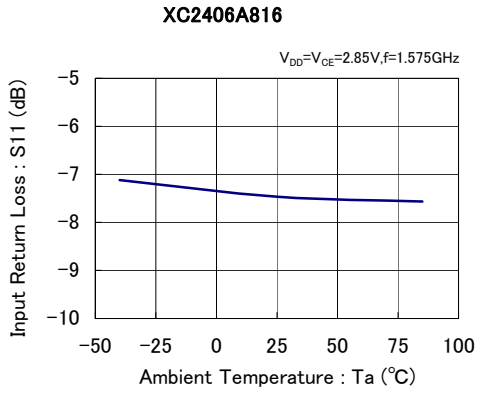


(12) Power Gain vs. Ambient Temperature

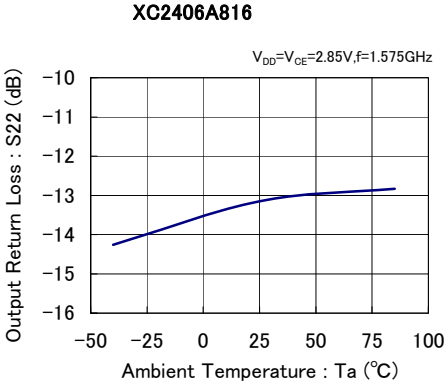


■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

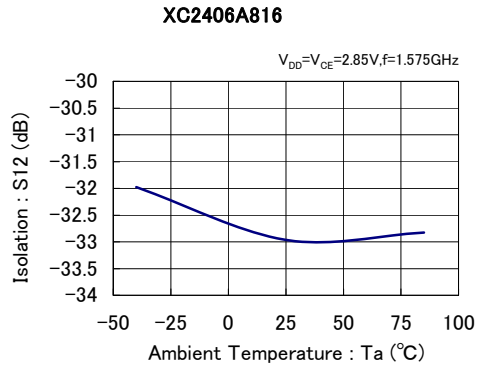
(13) Input Return Loss vs. Ambient Temperature



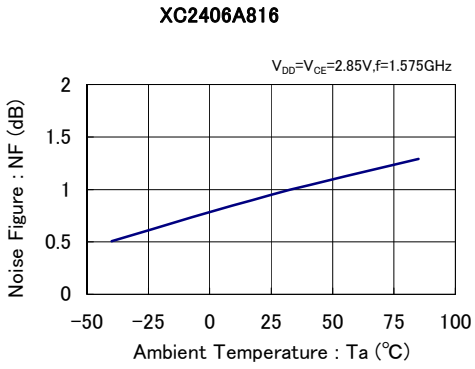
(14) Output Return Loss vs. Ambient Temperature



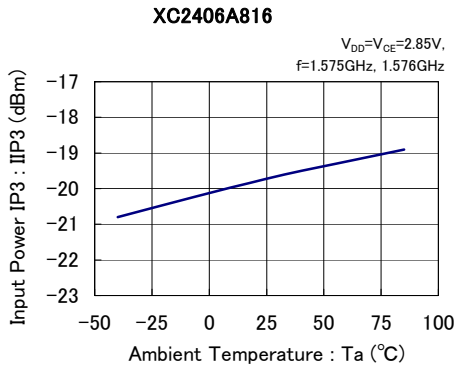
(15) Isolation vs. Ambient Temperature



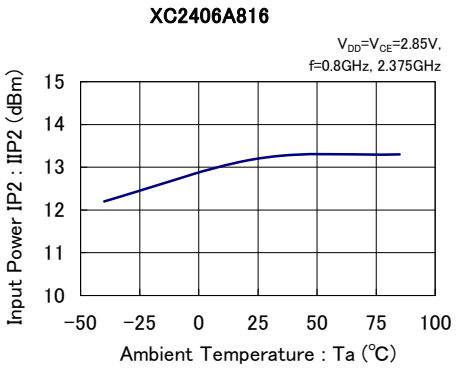
(16) Noise Figure vs. Ambient Temperature



(17) Input Power IP3 vs. Ambient Temperature

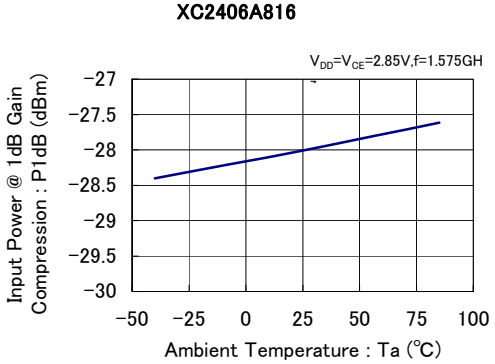


(18) Input Power IP2 vs. Ambient Temperature

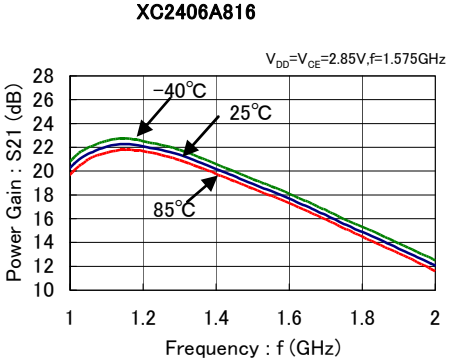


■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

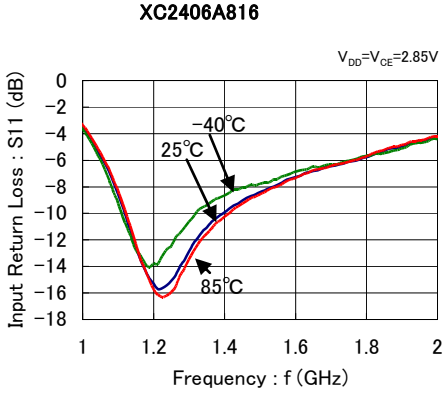
(19) Input Power @ 1dB Gain Compression vs. Ambient Temperature



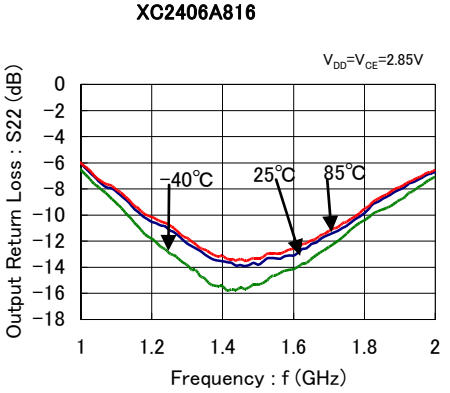
(20) Power Gain vs. Frequency



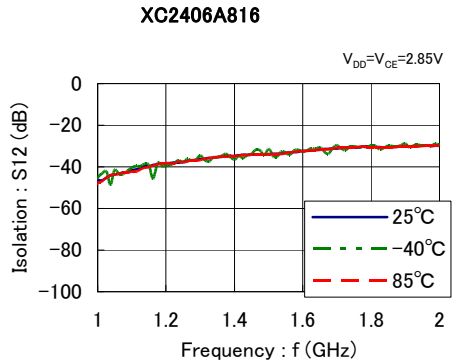
(21) Input Return Loss vs. Frequency



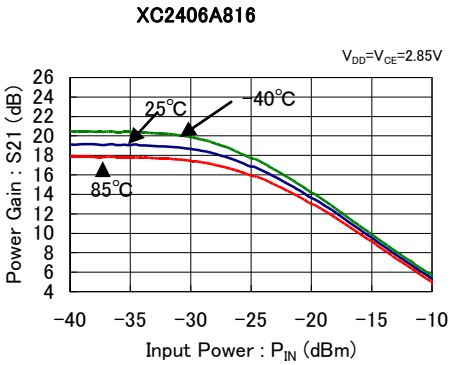
(22) Output Return Loss vs. Frequency



(23) Isolation vs. Frequency

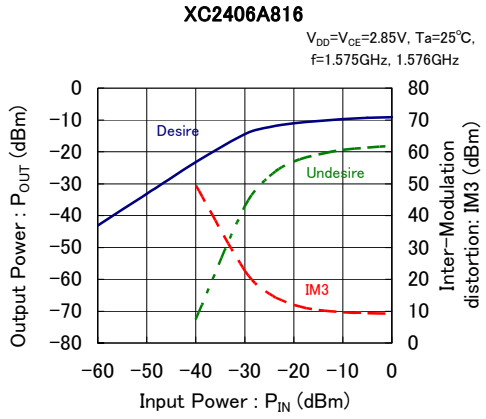


(24) Power Gain vs. Input Power

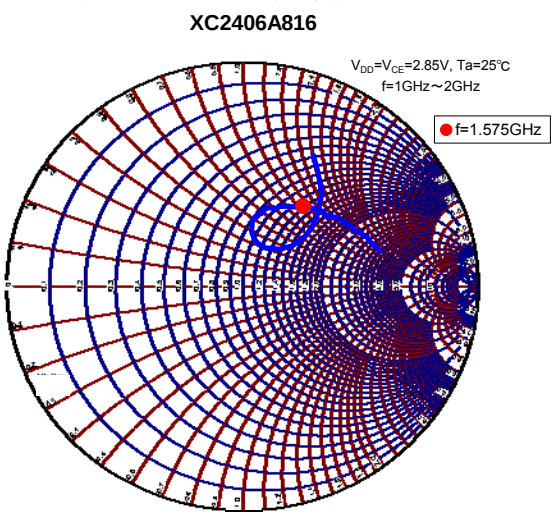


■TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

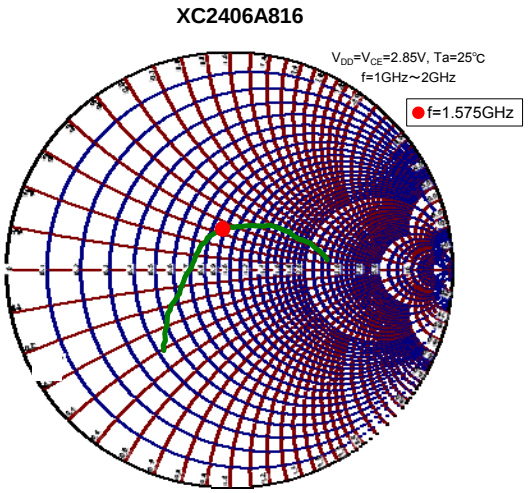
(25) Output Power / IM3 vs. Input Power



(26) Input Return Loss vs. Frequency (Smith Chart)

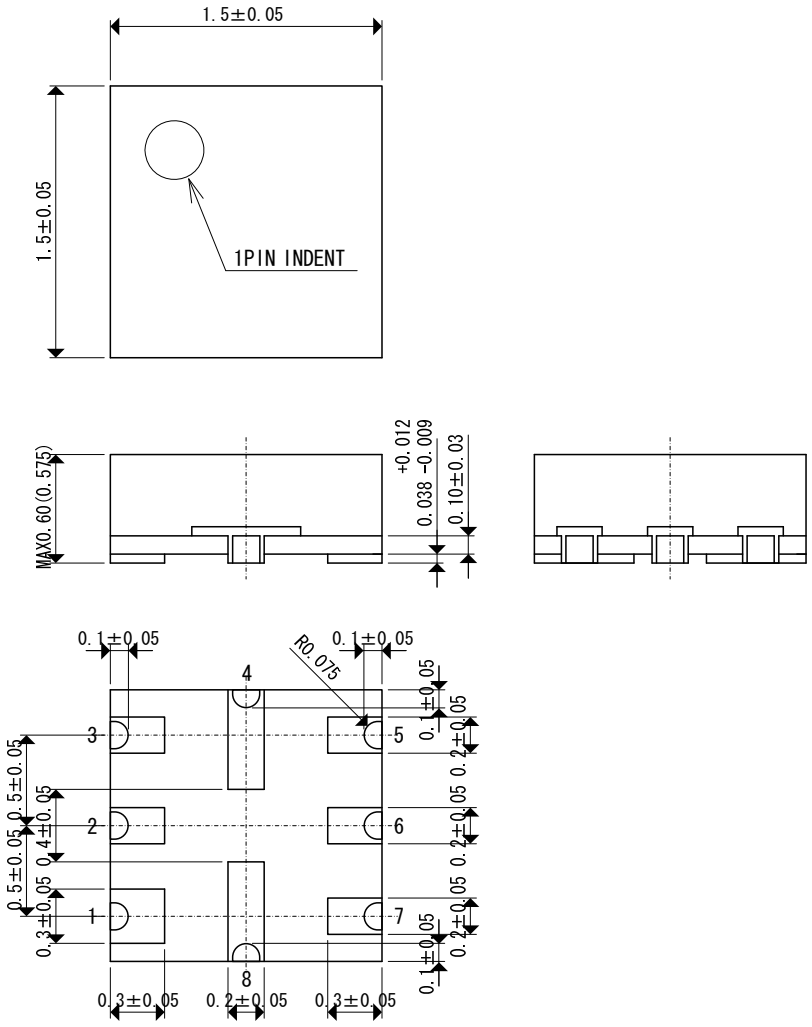


(27) Output Return Loss vs. Frequency (Smith Chart)



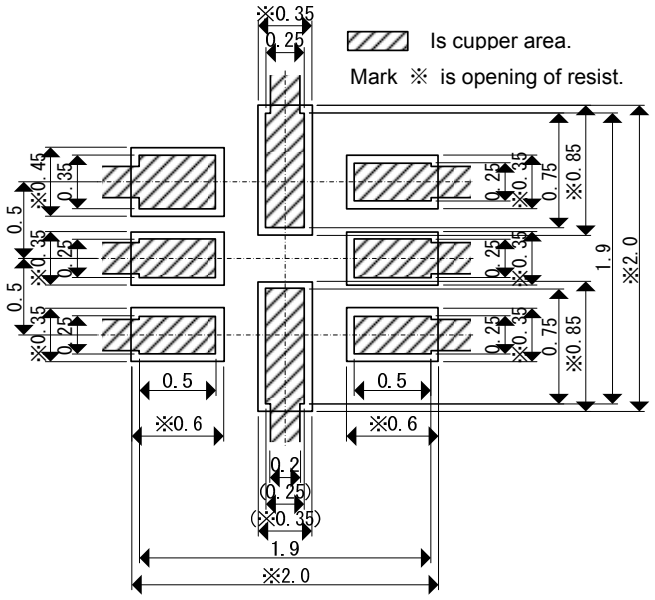
■PACKAGING INFORMATION

●USP-8A01 (unit:mm)

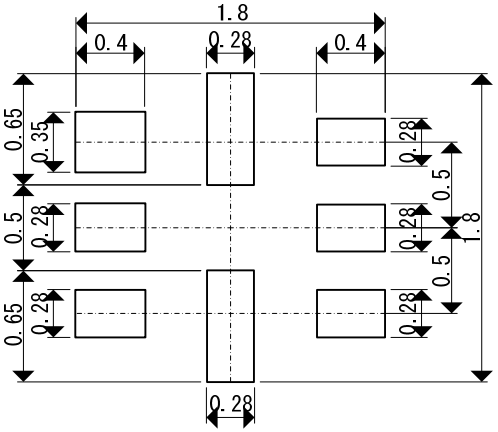


■PACKAGING INFORMATION (Continued)

●USP-8A01 Reference Pattern Layout (unit:mm)

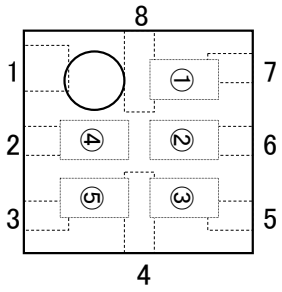


●USP-8A01 Reference Metal Mask Design (unit:mm)



■MARKING RULE

USP-8A01



① represents product series.

MARK	PRODUCT SERIES
6	XC2406******-G

② represents product.

MARK	PRODUCT SERIES
②	
A	XC2406A*****-G

③ represents product.

MARK	PRODUCT SERIES
③	
8	XC2406*8****-G

④,⑤ represents production lot number.

01 to 09, 0A to 0Z, 11 to 9Z, A1 to A9, AA to AZ and B1 to ZZ in order.
(G, I, J, O, Q, W excepted)
*No character inversion used.

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